Regional Economic Benefit Analysis Overview

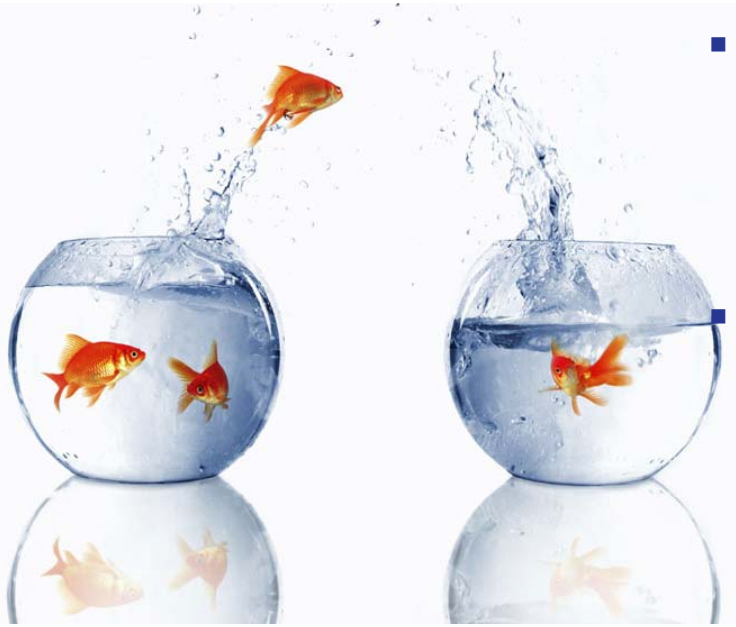
May 4, 2010

Overview

- **What is REBA?**
- **What are the assumptions/ Methodology?**
- **2009 REBA Results**
- **How can REBA inform Cluster Studies [Discussion]?**

What is REBA?

Congestion and Production Cost Analysis



- Provides strategic guidance to the Agency on how to proceed with builds identified in the Network Open Season Cluster Study
- Measure several economic aspects resulting from the modeling of Network Open Season (NOS) identified Transmission Service Requests (TSRs) into the Northwest and Western interconnected transmission system
- Production Cost Model helps:
  - Perform an optimal power flow using security constrained generating unit commitment and dispatch

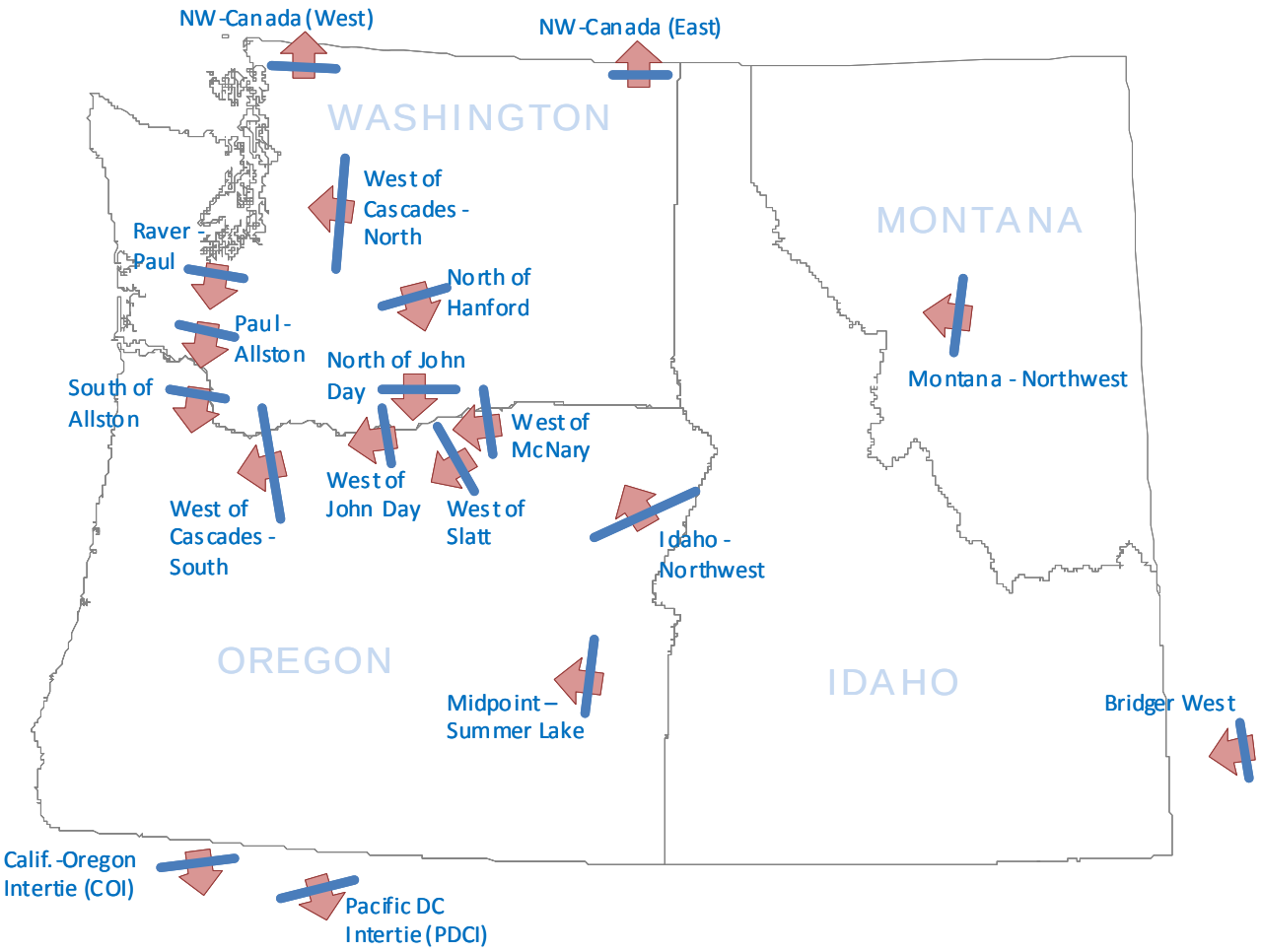
Scope

- Is there a reduction in future variable production costs (fuel and variable O&M) resulting from system operational changes with the addition of the 2009 NOS generation?
- What is the effect on BPA's internal flowgate loadings with the 2009 NOS generation additions?
- Is there a significant change in production costs and internal flowgate loadings due to the imposition of carbon dioxide costs?
- Are the transmission improvements identified in 2008 NOS adequate to accommodate the additional requests under the 2009 NOS?

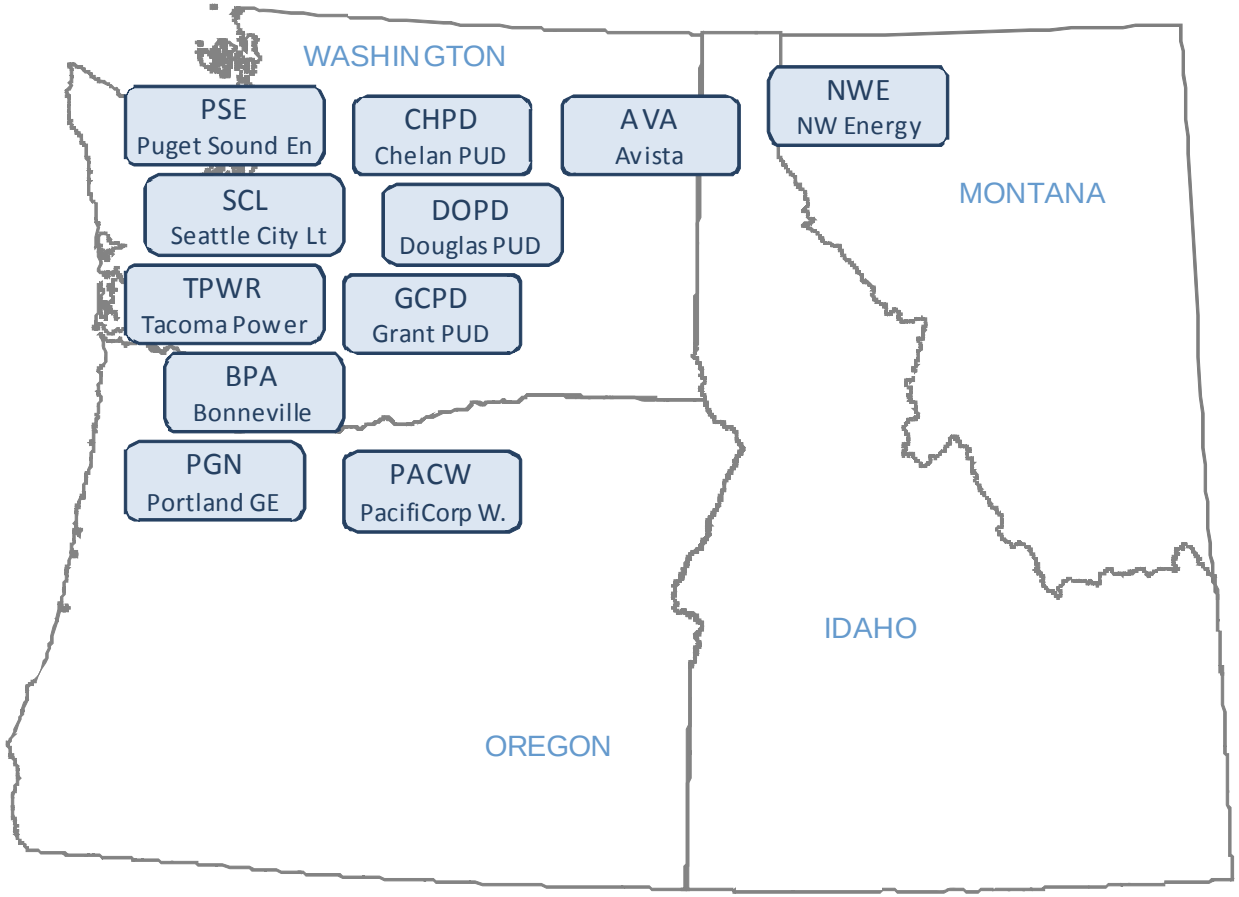
Cluster Study vs. REBA

- The intent of the Cluster Study is to identify the transmission requirements in order for BPA to provide firm service to the requests embodied in the PTSAs.
- The REBA considers the reinforcements identified in the Cluster Study only if REBA assessment indicates congestion. Same time, REBA provides strategic input to Cluster Studies on potential congestion area for further consideration.

Monitored Transmission Paths



NW Load Areas (Gridview)



Assumptions

- Precedent Transmission Service Agreements (PTSAs) were separated into those associated with new generation and those deemed to be used for existing generation or other uses.
- The simulator modeled the Western Interconnection as a 'single-owner' system, seeking an overall optimal operation (minimizing cost).
- Variable costs for wind-powered electricity are assumed to be negligible
- Path loadings were considered high if there were hours at or above 75% of the path's limit
- Prices studied for carbon dioxide emissions were based on the EIA-estimated cost resulting from the Waxman-Markey bill (for the lower $28/ton price), and from the Northwest Power and Conservation Council's trajectory of CO2 prices in its sixth power plan (for the higher $45/ton price).

Assumptions

- Study assumes a 2002 hydro condition for the Northwest (near median), expected loads for the 2019 timeframe, and typical wind based on NREL data.
- Forced outage of generators and transmission is not modeled.
- Generation units are dispatched hourly to meet load requirements in a system in such a way to most economically meet the amount of energy and capacity required while maintaining reliability and other operating concerns
- Cost recovery of the capital costs of generation and transmission additions and allocation of costs or savings are not part of this analysis.

Methodology

- Production cost impacts estimated using an hourly chronological dispatch model with sufficient transmission resolution and load and resource definition to reasonably value the transmission improvements.
- GridView model used to perform the required analyses.
- The model tabulates theoretical production cost fuel savings the combined system could save if dispatched solely on the assumed production costs.
- Does not calculate how such savings might change or be allocated if generating units were bid or dispatched on market based prices or other instead of incremental fuel costs.
- It also assumes transmission capital costs are sunk and dispatch is not influenced by wheeling rates.
- Calculates transmission flows resulting from the dispatch and as limited by flowgate and transmission limits. It observes flowgate limits based on actual flows computed and not scheduled flow limits.

Methodology

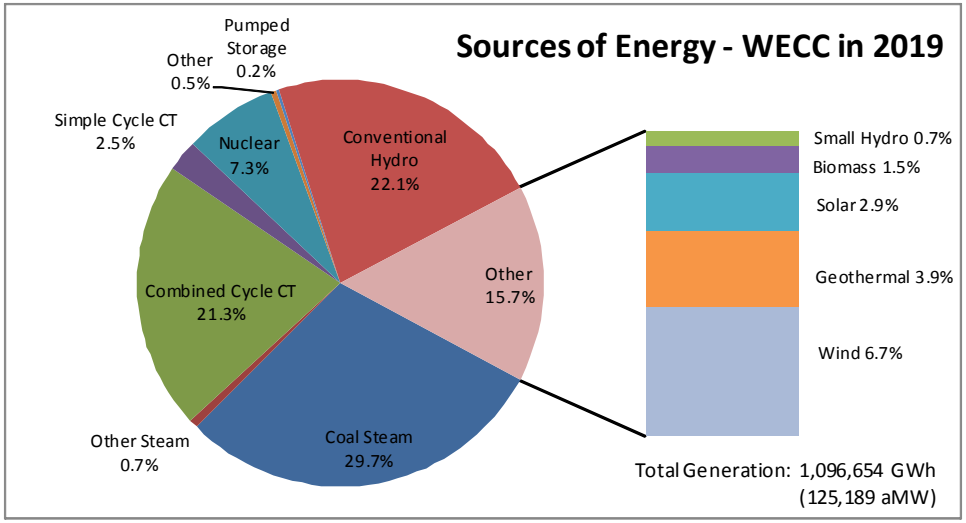
- The model assumes that if an optimum dispatch can be attained with resulting flows within flowgate actual flow limits, a representative set of schedules would be theoretically possible.
- It does not reflect long term transmission reservation rights that might go unused because a beneficial transaction could not be negotiated.
- Flow loading results are shown with paths loaded to 75% or more, 90% or more and 99% or more hours of their maximum limits.
- Transmission congestion on the grid occurs when transmission flows or schedules resulting from a generation and load pattern reach transmission path limits.
- When path limits are reached (or predicted to be reached or exceeded), generation must be changed to keep flows within reliability limits.
- This analysis is a relative comparison study.

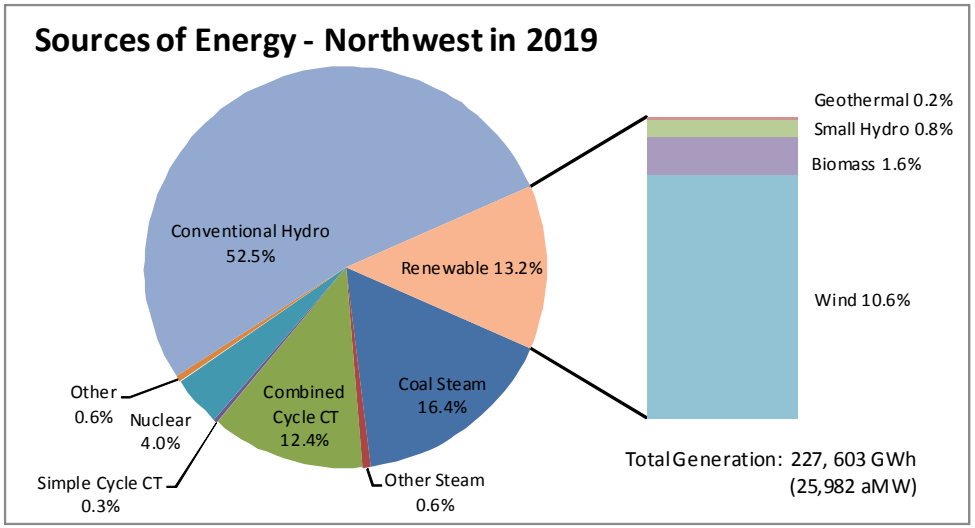
Analysis

Scenarios Considered

- The Base Case
- NOS representation
- CO2 sensitivity
- Impact of a $5/MWh wheeling charge

Sources of Energy to Serve Loads

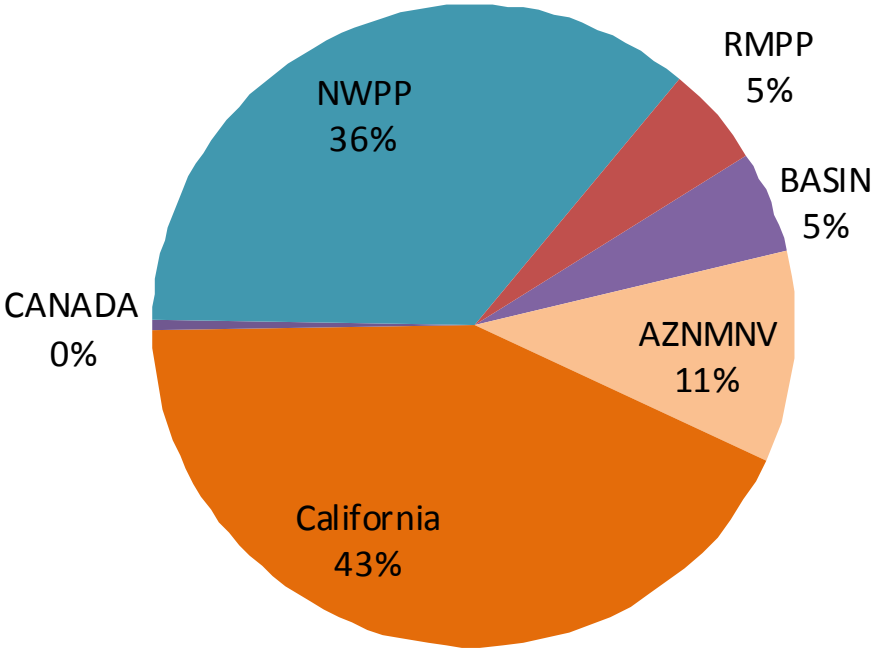




Annual Variable Cost Savings

Production Cost Savings in 2019
Share of $123 Million Total, by Sub-Region

Sub-Region	Savings
BASIN	$6
AZNMNV	$13
California	$53
CANADA	$1
NWPP	$44
RMPP	$6
Total WECC	$123



Path and Flowgate Congestion, Variable Costs, and Emissions

Annual Hours at or Above 75% of Path or Flowgate Rating	Base Case	Base Case, Plus $28/Ton CO2 Cost	Base Case, Plus $45/Ton CO2 Cost	with 2009 NOS Projects	with NOS, Plus $28/Ton CO2 Cost	with NOS, Plus $45/Ton CO2 Cost	with NOS, plus $5/MWh Ext. Wheeling
Internal							
North of Hanford	8	4	4	**9**	4	5	2
North of John Day	245	230	207	**242**	230	197	218
Paul - Alston	-	-	-	**-**	-	-	-
Raver - Paul	4	4	20	**8**	4	18	13
South of Allston	46	40	35	**46**	37	34	24
West of Cascades - North	244	255	258	**258**	264	261	293
West of Cascades - South	15	14	14	**19**	18	16	32
West of John Day	6	5	6	**36**	33	37	12
West of McNary	-	-	-	**-**	-	-	-
West of Slatt	-	-	-	**-**	-	-	-
External							
NW to Canada West BC	42	39	39	**39**	43	35	25
NW to Canada East BC	1,828	1,710	1,634	**1,804**	1,716	1,639	1,833
Montana - Northwest	3,666	3,161	1,902	**3,632**	3,062	1,725	3,287
Idaho-Northwest	440	275	132	**406**	262	123	49
Midpoint - Summer Lake	1,339	548	138	**1,411**	529	124	453
Bridger West	1,996	1,906	1,951	**2,102**	1,993	2,200	7,398
Calif.-Oregon Intertie (COI)	2,397	1,833	908	**2,623**	2,035	1,074	2,159
Pacific DC Intertie (PDCI)	98	-	-	**160**	5	-	88

Generation Cost, $Millions (Thermal generation only)

	Base Case	Plus $28 CO2	Plus $45 CO2	w/2009 NOS	Plus $28 CO2	Plus $45 CO2	w/$5 Ext. Whl.
WECC Total	$24,790	$38,128	$45,993	**$24,666**	$37,974	$45,824	$24,645
AZNMNV	$6,767	$10,239	$12,395	**$6,754**	$10,216	$12,376	$6,725
BASIN	$1,665	$3,875	$4,906	**$1,659**	$3,863	$4,888	$1,548
California	$7,868	$10,188	$11,790	**$7,815**	$10,135	$11,739	$8,207
CANADA	$4,059	$6,249	$7,588	**$4,058**	$6,247	$7,587	$4,071
NWPP	$2,764	$4,239	$5,018	**$2,720**	$4,180	$4,946	$2,484
RMPP	$1,666	$3,338	$4,296	**$1,660**	$3,334	$4,288	$1,609

Includes only fuel and variable operations and maintenance costs

Carbon Dioxide Emissions (Thermal generation only)

	Base Case	Plus $28 CO2	Plus $45 CO2	w/2009 NOS	Plus $28 CO2	Plus $45 CO2	w/$5 Ext. Whl.
WECC Amount (Short Tons)	483,405,859	466,922,546	451,030,116	**482,390,752**	465,868,336	449,794,694	482,143,134
WECC Cost ($millions)	$0	$13,073	$20,296	**$0**	$13,044	$20,241	$0

Observations

- 2009 TSRs may be accommodate with the transmission improvements identified in the 2008 NOS Cluster Studies, with
  - Increased transmission loadings and substantial production cost savings
  - 36% savings in the Northwest, 54% accrue to the Pacific Southwest, and balance in Rocky Mountain and Great Basin Regions.
- While the 2009 NOS Cluster Study identified additional expansion (Northern Intertie and West of Garrison), the REBA first examined congestion on the system without including these projects. Because the results of that assessment did not reflect actual congestion in these areas, the inclusion of these projects was considered to not be necessary for reducing congestion on the system.

Observations (contd.)

- Lack of wind-diversity regime
  - New wind generators have peak and minimum output at the same time
  - At peak wind output, most of the Northwest fossil generation is already displaced by previously-built wind generators, the new additions displace out-of-region generators.
- Congestion on BPA's network flowgates increases
  - The West of John Day flow gate shows a significant increase in congestion, as coincident peak wind pushes to get to the California interties.
- Consideration, by the simulation model, of generator and transmission forced outages would result in greater price volatility and periods of increased congestion.

CO2 Sensitivity

- The production cost benefit is larger.
  - CO2 cost pushes dispatch away from lower fuel cost coal-fired to higher fuel cost natural gas-fired generators, and the added (zero-cost) resources displace the highest-cost of the gas-fired generators.
  - Variable production-cost savings increase by 24% when CO2 is priced at $28/ton and are 38% higher with a $45/ton price.
- Congestion is reduced on most paths and flowgates, particularly out of coal-producing regions and into California

$5/MWh Wheeling Cost

- Placing a $5/MWh wheeling charge on all interfaces between the Northwest and other regions increases inter-regional price disparities and price volatility.
  - Flows across all external interfaces are reduced significantly (it costs $10/MWh to move power from Wyoming to the Northwest and then from the Northwest to California).
  - Locational marginal prices are reduced in the Northwest, increased in the Southwest.

Conclusions

- The energy produced by the new wind generators will displace highest-cost generation, much of which is located outside the Northwest.
- The new wind generation is co-located with substantial existing and 2008 NOS wind generation, resulting in amplification of issues.
- The transmission grid, with the reinforcements introduced with the 2008 NOS analysis, is adequate to support the 2009 NOS TSRs, though congestion does increase on many paths and flow gates.

How can REBA inform Cluster Studies

OPEN DISCUSSION

Questions?